

I – Problem Statement Title (04-EQ042)

Determining the Live Load Capacity of Bridges Designed to Caltrans Seismic Design Criteria Following a Major Seismic (Design) Event

II - Research Problem Statement

Question: What is the traffic carrying capacity of a bridge designed to meet Caltrans Seismic Design Criteria (SDC) following a major seismic (Design) event?

Develop guidelines, based on analytical studies and physical testing, for estimating the live load capacity of bridges (meeting the SDC) following a Design seismic event. These guidelines are necessary for timely and effective emergency response following such an event.

III – Objective

The research objective is to develop guidelines for estimating the live load capacity of bridges of modern design meeting the SDC following a Design event.

IV – Background

Bridges of modern design are expected to perform very well in a major seismic event. However, it is not known at this time how much, if any, live load such a structure will be able to carry after a major seismic event. Since California has a significant number of these modern structures located on Lifeline Routes, it is essential that their ability to carry emergency traffic, following a Design event, be determined. A lifeline route is a route that is deemed so critical to emergency response that it must remain open to emergency traffic immediately after a major earthquake.

Currently, there are no guidelines for assessing the level of damage to a bridge (Ductility Levels), and then making a determination if a structure is safe to open to emergency traffic. While most Caltrans engineers are of the opinion that bridges meeting the SDC will be able to carry at least a limited amount of emergency traffic following a Design event, this has not been verified.

V – Statement of Urgency and Benefits

A. Support of the Department’s Mission and Goals

(Improving Mobility: Safety, Reliability, and Performance) The State of California has designated several routes as “Lifeline Routes” on its highway system; bridges on Lifeline Routes that have no local detours must remain open in order to ensure emergency traffic can travel the Lifeline Route. However, there are no guidelines for estimating the level of damage to a bridge meeting the SDC, and the capacity of these bridges to carry emergency traffic following a Design seismic event.

The results of this project will provide post-earthquake investigation teams with the necessary guidelines for assessing the level of damage to a bridge and determining if the bridge is safe to open to emergency traffic following a major event.

B. Return on Investment

Providing immediate and effective response following a major seismic event will be critical for minimizing loss of life and restoring public services. The use of Lifeline and other routes following a large seismic event will be essential in order to achieve this goal. The results of this research will provide post-earthquake investigations teams with the necessary guidelines for opening bridges located on Lifeline and other routes, thus making emergency response more timely and effective. This research will also include recommended changes to the SDC (if necessary) in order to ensure future bridges will be able to carry emergency traffic.

The results of this project will also provide state and local managers with essential information for planning emergency response following a major seismic event.

VI – Related Research

Current research project with UC San Diego “Capacity Assessment and Visual Inspection Cataloging of Earthquake Damaged Reinforced Concrete Bridge Members”. The Principal Investigator is Lelli Van den Einde, and the project is scheduled for completion in June 2005.

VII –Deployment Potential

The proposed research will provide guidelines for determining the live load capacity of a bridge meeting the SDC following a design event. These guidelines will be included in Caltrans’ codes and will be used in post earthquake investigations to determine a structure’s ability to carry emergency traffic. The development of these guidelines will lead to improved emergency response following a major seismic event.